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(54) SEMICONDUCTOR FILM BOLOMETER THERMAL INFRARED DETECTOR

THERMISCHER INFRAROTDETEKTOR DES BOLOMETERTYPS MIT HALBLEITERFILM

DETECTEUR THERMIQUE A INFRA-ROUGE DU TYPE BOLOMETRE AVEC FILM SEMICONDUCTEUR

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Description

The present invention relates to an infrared detector, a two dimensional array of such detectors and to a method of fabrication of such a detector.

The infrared detector of the present invention relates to resistance bolometer type detectors, whereby radiation incident on the detector is absorbed, causing a rise in the temperature of the detector and a change in electrical resistance. This resistance change is observable as a variation in the electrical bias current or voltage applied to the detector. Resistance bolometers employing thin films are known. Reference may be made to a paper by K.C. Liddiard, entitled "Thin Film Resistance Bolometer IR Detectors" published in Infrared Physics, Vol.24, No.1, p.57, January 1984, and other references cited therein. According to WO82/01066 (corresponding to EPA No. 0 060 854) there is provided a infrared detector comprising a supporting substrate with a cavity formed therein, a dielectric pellicle of low thermal conductivity suspended over the cavity in the substrate and a heat-sensitive layer with thin metallic contacts thereto deposited on the pellicle. However, the above paper and published patent application relate to metal film bolometer detectors, wherein the heat sensitive material is a thin metal film. These detectors have a low temperature coefficient of resistance (TCR) and low electrical resistance, which together give very small signal levels in the nanovolt range. Consequently, the infrared responsivity measured as the ratio of signal voltage to incident radiant power is also small, typically less than 100 volts per watt. It is the objective of the present invention to improve the detecting ability by employing a semiconductor film as the heat sensitive material. Both the TCR and electrical resistance are much larger, resulting in signal levels in the microvolt range, with responsivities exceeding 10000 volts per watt. Such high signal levels, together with a smaller power dissipation, make the semiconductor bolometer more suitable for large focal plane arrays. U.S. Patent No. 4116063 describes a bolometer designed specifically to operate at a very low temperature, and has a sensitive element of a semiconductor crystal extended on two faces by beams of the same material, but of smaller cross-section which have been metallised. U.S. Patent No. 3069644 describes a bolometer comprising an evacuated envelope having a glass frame, a thin film of insulating material with spaced strips of metallic film on the insulating film, and a thin elongate layer of semiconducting material extending across the strip. A semiconductor film bolometer infrared detector has been described in a paper by K.C. Liddiard titled "Thin Film Resistance Bolometer IR Detectors - II", published in Infrared Physics, Vol.26, No.1, p.43, January 1986. EP-A-0354369 describes an infrared detector comprising a semiconductor resistor suspended over a substrate. In order to detect heat efficiently at a particular wavelength (λ), the semiconductor resistor is positioned over the substrate at a height of $\lambda/4$ in a vacuum to form an optical interference filter. The processing required to fabricate such a detector is, however, complicated.

According to a first aspect of the present invention there is provided an infrared detector comprising a supporting substrate with a cavity formed therein, a dielectric pellicle of low thermal conductivity material suspended over the cavity in the substrate and a heat-sensitive layer with thin metallic contacts thereto deposited on the pellicle, characterised in that the dielectric pellicle includes holes or slots through which the cavity is formed by etching and the heat-sensitive layer with thin metallic contacts is an optical interference filter in which a heat-sensitive semiconductor layer is sandwiched between first and second thin film metallic contacts formed as layers, the thickness of the heat-sensitive semiconductor layer being substantially equal to one quarter of the wavelength of the infrared wavelength to be detected, multiplied by its refractive index.

According to a second aspect of the present invention there is provided a two-dimensional array of infrared detectors of the first aspect of the invention.

According to a third aspect of the present invention, there is provided a method of fabricating an infrared detector including the steps of:-

a) thermally oxidising the surface of a silicon substrate and patterning a window through the resultant oxidised surface;
b) depositing a layer into the window which is relatively easy to etch, as compared to the substrate and the oxidised surface;
c) depositing a dielectric film of low thermal conductivity over the thus formed substrate;
d) forming a first thin metallic film on the dielectric film with a preselected conductor pattern;
e) forming a heat-sensitive semiconductor layer on selected areas of the first metallic film, the layer having a thickness substantially equal to one quarter of the wavelength of the infrared to be detected, multiplied by its refractive index;
f) forming a second thin metallic film on the heat-sensitive semiconductor layer with a preselected conductor pattern, the first and second metallic films, and the heat-sensitive semiconductor layer, forming an optical interference filter; and
g) patterning holes or slots through to the layer formed in step b) and etching away this layer to leave the dielectric pellicle suspended over an opening in the oxidised supporting substrate.

Reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is a schematic plan view of a detector element embodying the invention;
Figure 2 is a sectional view, taken though A-A of Figure 1;

Figure 3 shows two sectional views of steps in a method embodying an aspect of the invention;
Figure 4 shows two alternative contact configurations in a detector embodying the invention; and
Figure 5 shows an array of detectors and an associated microelectronic circuit on the same substrate.

Referring to Figures 1 and 2, there is shown a plan view of a detector element 1 provided on a substrate of monocrystalline silicon wafer (or slice) which has a (1-0-0) surface orientation, of the type employed for the manufacture of monolithic microcircuit devices. The detector element 1 comprises a bottom electrical contact 2, a semiconductor layer 3, and a top electrical contact 4. The pellicle is designated 5, silicon wafer substrate 6, and silicon dioxide insulator layer 7. Etch holes are numbered 8 and the electrical connection joining the detector element to a nearby electronic amplifier is shown as 9.

The detector is prepared as follows:

The substrate is first thermally oxidised, according to established practice, and windows are patterned in the silicon dioxide layer so formed by conventional photolithographic techniques using a hydrofluoric acid etchant. These windows, which extend to the surface of the silicon wafer, define the area where the pellicle is to be formed.

A suitable material is then deposited, which will later be removed but for the present fills the windows in the silicon dioxide. This material, which we shall refer to as the under-etch layer, is shown as component 10 in Figure 3. The under-etch layer may be polycrystalline or amorphous silicon, deposited by chemical vapour deposition, sputter deposition, or thermal evaporation. In an alternative embodiment, the under-etch layer may be an amorphous dielectric material such as a glass or silicon dioxide deposited by chemical vapour deposition. Layers of this latter type are widely employed in microcircuit fabrication processes. The main requirement is that the under-etch layer can be removed by an appropriate etchant at a significantly faster etch rate than the window and pellicle materials.

The thickness of the under-etch layers is approximately the same as the window depth, such that the surface of the layer is coplaner with the upper surface of the oxidised wafer. Conventional lithographic techniques are again used to pattern the under-etch layer and produce the desired geometry. In the alternative embodiment, the under-etch layer may be deposited and planarised as a component layer of the particular microcircuit process used for preparation of the associated electronic circuit.

A thin dielectric film is then deposited over the entire wafer. This film, shown as the pellicle (5) in Figures 1, 2 and 3, must be a material having a low thermal conductivity, in order to minimise lateral heat loss from the detector element. It is also desirable that the deposition parameters be selected to produce a film with low mechanical stress, so as to avoid fracture after removal of the under-etch layer. The preferred pellicle materials are silicon nitride or silicon oxynitride prepared by chemical vapour deposition. An aluminium oxide film deposited by thermal evaporation, or a polyimide film prepared by established microelectronic processing methods, have also been found to be suitable options for pellicle fabrication. The thickness of the pellicle film will normally be in the range 50 to 250 nanometre, but polyimide films may be thicker due to the very low thermal conductivity typical of this material.

The first, or lower, contact film is then prepared as follow:

A thin metal film is deposited by sputter deposition or thermal evaporation onto the pellicle layer. This film will act as the bottom electrical contact for the heat sensitive semiconductor layer, and may also serve as the electrical conductor connecting the detector element to the external electronic circuit. The metal film is also an essential component of the infrared absorption mechanism of the detector design.

The desired geometrical shape of the metal film is produced by conventional photolithography using the lift-off technique, or alternatively sputter or plasma etching. The thickness of the film must be as small as possible to minimise lateral heat loss. For the same reason, the width of the film where it forms the electrical interconnect conductor (shown as (9) in Figure 1) must also be small.

In the preferred embodiment the contact material is a thin film of platinum or a refractory metal such as tantalum. It should be understood that thermal annealing carried out during detector processing may convert the metal to a silicide, depending on the annealing temperature. This will be caused by diffusion and reaction with the semiconductor layer which forms the heat sensitive element of the detector. Other metals which have been found to be suitable options, particularly for research purposes, include nickel or nickel-chromium alloy.

The next process step is deposition of the semiconductor heat sensitive layer. The preferred material is amorphous silicon prepared by low pressure chemical vapour deposition (LPCVD) or by plasma-enhanced chemical vapour deposition (PECVD), the latter also known as RF glow discharge deposition. These techniques produce amorphous silicon layers from chemical dissociation of silane gas, the resultant layer containing a varying proportion of hydrogen to give a material called hydrogenated amorphous silicon (a-Si:H). Sputter deposition from a silicon cathode in the presence of hydrogen produces a layer of similar characteristics, and this technique has been successfully employed as an optional method of preparation.

An alternative to an a-Si:H layer is a polycrystalline silicon layer prepared by thermal annealing of a LPCVD silicon deposit in a manner common to fabrication of VLSI microcircuit devices. This method may be preferred

when the detector is prepared by high temperature processing in conjunction with an associated microelectronic circuit. By comparison, a-Si:H layers are produced at lower temperatures, and will normally be deposited after preparation of the microcircuit.

Depending on deposition conditions and detector geometry, the electrical resistivity of the semiconductor layer may be of the correct order of magnitude for satisfactory detector performance. It may, however, be desirable to introduce a suitable dopant material such as boron or phosphorus by addition of a small partial pressure of the desired gas, e.g. diborane or phosphine, during deposition. Alternatively, the dopant may be introduced by ion implantation. In this manner it is possible to achieve the specified electrical resistivity, hence resistance, of the detector element. The method chosen usually involves a compromise between the desired electrical resistivity and temperature coefficient of resistance (TCR).

The thickness of the semiconductor layer is chosen to give optimum infrared absorption, as described later in this specification. The layer is patterned by conventional photolithography using a chemical etchant, or by sputter, plasma or reactive ion etching.

Referring to Fig. 4, two alternative contact configurations are shown.

The top contact film will usually, but not necessarily, be of the same composition as the bottom contact film, and will have a thickness chosen to optimise infrared absorption. The film will again be patterned by the lift-off technique, or by sputter of plasma etching.

Research has shown that the electrical characteristics of the detector contacts can be advantageously modified by shallow doping of the semiconductor, which assists in the achievement of low contact resistance. An ohmic contact can also be obtained with a thin film of pure amorphous silicon between the metal and semiconductor layer.

The use of a second (top) contact, as described above, enables an enhanced absorption to be achieved by virtue of the formation of an optical interference filter. The theory of this filter has been given by P.A. Silberg, in a paper titled "Infrared Absorption of Three-Layer Films", J. Opt. Soc. Amer., Vol. 47, No. 7 p 575, 1957; and the application to pyroelectric infrared detectors has been described in the article titled "Thin Film Absorber Structures for Advanced Thermal Detectors", J. Vac. Sci. Technol. A, Vol. 6(3), p 1686, May/June 1988.

There is, however, no known reference to the application of this technique to monolithic thin film bolometer infrared detectors. In this case, the bottom thin film metallic contact should be a perfect reflector at infrared wavelengths, whilst the top contact should have a nominal sheet resistance of 377 ohm per square. The thickness of the semiconductor heat sensitive layer must now be equal to $\lambda/4n$, where λ is the wavelength of maximum absorption and n is the refractive index of the semiconductor layer. The thickness will usually be chosen to attain maximum infrared absorption at 10μm wavelength.

In practice it is found that the resistance of the metallic contact films are not critical - an absorption of at least 90% is achieved for the 8 to 12μm waveband when the resistance of the bottom contact is less than 10 ohm per square, and that of the top contact is 300 to 500 ohm per square.

The final process step is thermal isolation of the detector element. During this step the detector element must be protected by depositing a layer of a suitable metal or dielectric material, which acts as an etch barrier. This layer may be aluminium, gold, silicon dioxide, silicon nitride or silicon oxynitride. Holes or slots are then patterned by chemical, sputter, plasma or reactive ion etching (or a combination of these), extending from the surface to the under-etch layer. At this stage it is also desirable to partially dice the substrate using a microcircuit dicing saw, to permit easy separation of individual detector arrays after thermal isolation.

If an under-etch layer other than silicon is employed then this layer must now be removed by etching through the holes or slots using the appropriate chemical etchant. If the under-etch layer is comprised only of silicon then this step may be omitted.

The substrate is then loaded in a glass or teflon holder and placed in a flask fitted with a reflux condenser. The flask contains an anisotropic silicon etchant, maintained at the required temperature by immersion in a temperature-controlled glycerol or oil bath. High purity nitrogen is circulated through the flask and the etchant is subjected to gentle agitation using magnetic stirring. The preferred etchant is ethylene diamine pyrocatechol (EDP). Hydrazine or potassium hydroxide may also be used. The choice of etchant may also dictate appropriate selection of the protective layer material.

During this process step (or steps) the under-etch layer is rapidly etched and removed through the etch holes to expose the underlying monocrystalline silicon substrate. The progress at this point is illustrated in Figure 3 (the protective layer is not shown for reasons of simplicity). The silicon substrate is then etched to form a pyramidal-shaped cavity beneath the detector element, conforming precisely to planes of crystal symmetry.

Following removal of residual etchant, thence rinsing and drying, the protective layer is removed and the detector elements are now seen to be supported on pellicles over the cavities formed in the substrate. It is noted that a protective layer such as silicon nitride may be retained to add strength to the pellicle, but this layer will contribute additional thermal capacitance and heat loss.

Individual detector arrays may now be separated from the substrate. In this regard, it should be understood that a number of arrays will normally be prepared on a single substrate by means of step-and-repeat artwork generated on photolithographic mask sets.

Alternative methods of thermal isolation involving

anisotropic etching through the rear surface of the substrate have been described in references cited in this specification. However, the present invention is concerned solely with monolithic single-sided wafer processing. A demonstrated option to the above procedure is to complete the cavity etch prior to deposition of the under-etch layer, all other processing steps remaining the same.

As noted earlier, the detector array may be integrated with a microelectronic circuit formed on the same silicon wafer substrate. This circuit will typically comprise voltage bias, signal amplification, sample-and-hold, and multiplexing components, prepared by VLSI microcircuit fabrication techniques. The choice of detector materials will determine the sequence of operations in a fully integrated process schedule. Thus polysilicon and refractory silicide metallisation can withstand the high temperatures of VLSI processing, whilst amorphous silicon and platinum-based metallisations must be deposited after completion of microcircuit preparation.

Following processing, individual array chips are mounted and wire bonded in a suitable microcircuit package. an infrared window comprised of one of the materials germanium, silicon, zinc sulphide or zinc selenide, is sealed to the package. Each side of the window is coated with an anti-reflection coating optimised for infrared transmission in the 8 to 12 μm waveband. The package is sealed in an atmosphere of nitrogen gas or, preferably, a gas having a low thermal conductivity such as xenon. A novel vacuum packaging technology has been developed, which comprises a desirable but not essential feature of the present invention. It may be noted that sealing in a vacuum or a low thermal conductivity gas reduces heat loss from the detector element, with a subsequent increase in detector response.

Claims

1. An infrared detector comprising a supporting substrate (6) with a cavity formed therein, a dielectric pellicle (5) of low thermal conductivity material suspended over the cavity in the substrate (6) and a heat-sensitive layer (1) with thin metallic contacts (9) thereto deposited on the pellicle (5), characterised in that the dielectric pellicle (5) includes holes or slots (8) through which the cavity is formed by etching and the heat-sensitive layer (1) with thin metallic contacts (9) is an optical interference filter in which a heat-sensitive semiconductor layer (3) is sandwiched between first and second thin film metallic contacts formed as layers (2, 4), the thickness of the heat-sensitive semiconductor layer (3) being substantially equal to one quarter of the wavelength (λ) of the infrared wavelength to be detected, multiplied by its refractive index (n).

2. An infrared detector according to claim 1, characterised in that the supporting substrate (6) is a monocrystaline silicon wafer and the cavity is formed by anisotropic etching using a chemical etchant selected from hydrazine, ethylene diamine pyrocatechol or potassium hydroxide.

3. An infrared detector according to claim 1 or 2, characterised in that the first conductor layer (2) has a resistance of less than 10 ohms per square and the second conductor layer (4) has a resistance of between 300 and 500 ohms per square, the second layer (4) being disposed above the first layer (2) in order to receive the first infrared radiation to be detected.

4. An infrared detector according to claim 1, 2 or 3, characterised in that the heat-sensitive semiconductor layer (3) is a layer of silicon prepared by sputter or chemical vapour deposition.

5. An infrared detector according to any one of the preceding claims, characterised in that the thin film metallic layers (2, 4) are formed from one or more layers of nickel, nickel-chromium, platinum, platinum silicide or tantalum silicide.

6. An infrared detector according to any one of the preceding claims, characterised in that the pellicle (5) is formed from aluminium oxide, silicon nitride, silicon oxynitride or a polyimide layer.

7. An infrared detector according to any one of the preceding claims, characterised in that associated signal amplifier, voltage bias, sample-and-hold and multiplexing electronic circuits are formed in the supporting substrate (6).

8. A two-dimensional array of infrared detectors, each infrared detector being as claimed in any one of the preceding claims and being provided on a supporting substrate (6).

9. A method of fabricating an infrared detector including the steps of:-

   a) thermally oxidising the surface of a silicon substrate (6) and patterning a window through the resultant oxidised surface (7);
   b) depositing a layer (10) into the window which is relatively easy to etch, as compared to the substrate (6) and the oxidised surface (7);
   c) depositing a dielectric film (5) of low thermal conductivity over the thus formed substrate;
   d) forming a first thin metallic film (2) on the dielectric film (5) with a preselected conductor pattern;
   e) forming a heat-sensitive semiconductor layer (3) on selected areas of the first metallic film

(2), the layer (3) having a thickness substantially equal to one quarter of the wavelength (λ) of the infrared to be detected, multiplied by its refractive index (n);

f) forming a second thin metallic film (4) on the heat-sensitive semiconductor layer (3) with a preselected conductor pattern, the first and second metallic films (2, 4), and the heat-sensitive semiconductor layer (3), forming an optical interference filter; and

g) patterning holes or slots (8) through to the layer (10) formed in step b) and etching away this layer (10) to leave the dielectric pellicle (5) suspended over an opening in the oxidised supporting substrate (6, 7).

Patentansprüche

1. Infrarotdetektor mit einem tragenden Substrat (6) mit einem darin gebildeten Hohlraum, einer dielektrischen Membrane (5) aus Material mit niedriger Wärmeleitfähigkeit, die über dem Hohlraum im Substrat (6) aufgehängt ist, und einer auf der Membrane (5) abgelagerten wärmeempfindlichen Schicht (1) mit dünnen Metallkontakten (9) daran, dadurch gekennzeichnet, daß die dielektrische Membrane (5) Löcher oder Schlitze (8) enthält, durch die der Hohlraum durch Ätzen gebildet wird, und die wärmeempfindliche Schicht (1) mit dünnen Metallkontakten (9) ein Interferenzlichtfilter ist, in dem eine wärmeempfindliche Halbleiterschicht (3) zwischen als Schichten (2, 4) ausgebildeten ersten und zweiten Dünnfilm-Metallkontakten angeordnet ist, wobei die Stärke der wärmeempfindlichen Halbleiterschicht (3)im wesentlichen gleich einem Viertel der Wellenlänge (λ) der zu erkennenden Infrarotwellenlänge multipliziert mit ihrer Brechzahl (n) ist.

2. Infrarotdetektor nach Anspruch 1, dadurch gekennzeichnet, daß das tragende Substrat (6) ein monokristalliner Siliziumwafer ist und der Hohlraum durch anisotropes Ätzen unter Verwendung eines unter Hydrazin, Ethylendiaminpyrocatechin oder Kaliumhydroxid ausgewählten chemischen Ätzmittels gebildet wird.

3. Infrarotdetektor nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die erste Leiterschicht (2) einen Widerstand von weniger als 10 Ohm pro Quadrat und die zweite Leiterschicht (4) einen Widerstand von zwischen 300 und 500 Ohm pro Quadrat aufweist, wobei die zweite Schicht (4) über der ersten Schicht (2) angeordnet ist, um die erste Infrarotstrahlung zu empfangen.

4. Infrarotdetektor nach Anspruch 1, 2 oder 3, dadurch gekennzeichnet, daß die wärmeempfindliche Halbleiterschicht (3) eine Siliziumschicht ist, die durch Aufsputtern oder chemische Aufdampfung hergestellt wird.

5. Infrarotdetektor nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Dünnfilm-Metallschichten (2, 4) aus einer oder mehreren Schichten von Nickel, Nickelchrom, Platin, Platinsilizid oder Tantalsilizid gebildet werden.

6. Infrarotdetektor nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Membrane (5) aus Aluminiumoxid, Siliziumnitrid, Siliziumoxinitrid oder einer Polyimidschicht gebildet wird.

7. Infrarotdetektor nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß im tragenden Substrat (6) zugehörige elektronische Signalverstärker-, Vorspannungs-, Abtast-und-Halte- und Multiplexschaltungen ausgebildet werden.

8. Zweidimensionale Anordnung von Infrarotdetektoren, wobei jeder Infrarotdetektor einem der vorhergenden Ansprüche entspricht und auf einem tragenden Substrat (6) bereitgestellt wird.

9. Verfahren zur Herstellung eines Infrarotdetektors mit folgenden Schritten:

(a) thermische Oxidierung der Oberfläche eines Siliziumsubstrats (6) und Strukturierung eines Fensters durch die sich ergebende oxidierte Oberfläche (7);

(b) Ablagern einer Schicht (10) im Fenster, die im Vergleich zum Substrat (6) und der oxidierten Oberfläche (7) verhältnismäßig leicht zu ätzen ist;

(c) Ablagern eines dielektrischen Films (5) geringer Wärmeleitfähigkeit über dem so gebildeten Substrat;

(d) Bilden eines ersten Dünnmetallfilms (2) auf dem dielektrischen Film (5) mit einer vorgewählten Leiterstruktur;

(e) Bilden einer wärmeempfindlichen Halbleiterschicht (3) auf ausgewählten Bereichen des ersten Metallfilms (2), wobei die Schicht (3) eine Stärke aufweist, die im wesentlichen gleich einem Viertel der Wellenlänge (λ) der zu erkennenden Infrarotstrahlung multipliziert mit ihrer Brechzahl (n) ist;

(f) Bilden eines zweiten Dünnmetallfilms (4) auf der wärmeempfindlichen Halbleiterschicht (3) mit einer vorgewählten Leiterstruktur, wobei der erste und zweite Metallfilm (2, 4) und die wärmeempfindliche Halbleiterschicht (3) ein Interferenzlichtfilter bilden; und

(g) Strukturieren von Löchern oder Schlitzen

(8) bis zu der im Schritt b) ausgebildeten Schicht (10) und Wegätzen dieser Schicht (10), um die dielektrische Membrane (5) über einer Öffnung im oxidierten tragenden Substrat (6, 7) hängen zu lassen.

Revendications

1. Détecteur à infrarouge comprenant un substrat de support (6) dans lequel est formée une cavité, une pellicule diélectrique (5) en une matière à faible conductibilité thermique, suspendue par-dessus la cavité pratiquée dans le substrat (6) et une couche thermosensible (1) comprenant de minces contacts métalliques (9) déposés sur la pellicule (5), caractérisé en ce que la pellicule diélectrique (5) englobe des trous ou des fentes (8) à travers lesquels on forme la cavité par gravure, et la couche thermosensible (1) munie de minces contacts métalliques (9) est un filtre d'interférence optique dans lequel une couche thermosensible à semi-conducteur (3) est intercalée entre des premier et second contacts métalliques en film mince réalisés sous forme de couches (2, 4), l'épaisseur de la couche thermosensible à semi-conducteur (3) étant essentiellement égale à un quart de la longueur d'onde (λ) de rayonnement infrarouge à détecter, multiplié par son indice de réfraction (n).

2. Détecteur à infrarouge selon la revendication 1, caractérisé en ce que le substrat de support 6 est une pastille de silicium monocristallin et la cavité est formée par gravure anisotrope en utilisant un agent de gravure chimique choisi parmi l'hydrazine, l'éthylènediamine-pyrocatéchol ou l'hydroxyde de potassium.

3. Détecteur à infrarouge selon la revendication 1 ou 2, caractérisé en ce que la première couche conductrice (2) possède une résistance inférieure à 10 ohm au carré et la seconde couche conductrice (4) possède une résistance entre 300 et 500 ohm au carré, la seconde couche (4) étant disposée pardessus la première couche (2) pour recevoir le premier rayonnement infrarouge à détecter.

4. Détecteur à infrarouge selon la revendication 1, 2 ou 3, caractérisé en ce que la couche thermosensible à semi-conducteur (3) est une couche de silicium préparée par métallisation sous vide ou par déposition en phase gazeuse par procédé chimique.

5. Détecteur à infrarouge selon l'une quelconque des revendications précédentes, caractérisé en ce que les couches métalliques à film mince (2, 4) sont formées à partir d'une ou de plusieurs couches de nickel, de nickel-chrome, de platine, de siliciure de platine ou de siliciure de tantale.

6. Détecteur à infrarouge selon l'une quelconque des revendications précédentes, caractérisé en ce que la pellicule (5) est formée à partir d'oxyde d'aluminium, de nitrure de silicium, d'oxynitrure de silicium ou d'une couche de polyimide.

7. Détecteur à infrarouge selon l'une quelconque des revendications précédentes, caractérisé en ce que des circuits électroniques associés d'amplification de signaux, de polarisation de tension, d'échantillonnage-et-de maintien et de multiplexage sont formés dans le substrat de support (6).

8. Réseau à deux dimensions de détecteurs à infrarouge, chaque détecteur à infrarouge étant tel que revendiqué dans l'une quelconque des revendications précédentes et étant prévu sur un substrat de support (6).

9. Procédé de fabrication d'un détecteur à infrarouge englobant les étapes consistant à :

   a) oxyder par voie thermique la surface d'un substrat (6) en silicium et pratiquer une fenêtre à travers la surface oxydée résultante (7);
   b) déposer une couche (10) dans la fenêtre qui peut être aisément gravée par comparaison au substrat (6) et à la surface oxydée (7);
   c) déposer un film diélectrique (5) de faible conductibilité thermique par-dessus le substrat ainsi formé;
   d) former un premier film métallique mince (2) sur le film diélectrique (5) avec un modèle de conducteur présélectionné;
   e) former une couche thermosensible à semiconducteur (3) sur des zones sélectionnées du premier film métallique (2), l'épaisseur de la couche (3) étant essentiellement égale à un quart de la longueur d'ondes (λ) du rayonnement infrarouge à détecter, multipliée par son indice de réfraction (n);
   f) former un second film métallique mince (4) sur la couche thermosensible à semi-conducteur (3) avec un modèle de conducteur présélectionné, les premier et second films métalliques (2, 4) ainsi que la couche thermosensible à semi-conducteur (3) formant un filtre d'interférence optique; et
   (g) pratiquer des trous ou des fentes (8) à travers la couche (10) formée à l'étape b) et éliminer cette couche (10) par gravure pour laisser la pellicule diélectrique (5) suspendue par-dessus une ouverture pratiquée dans le substrat de support oxydé (6, 7).

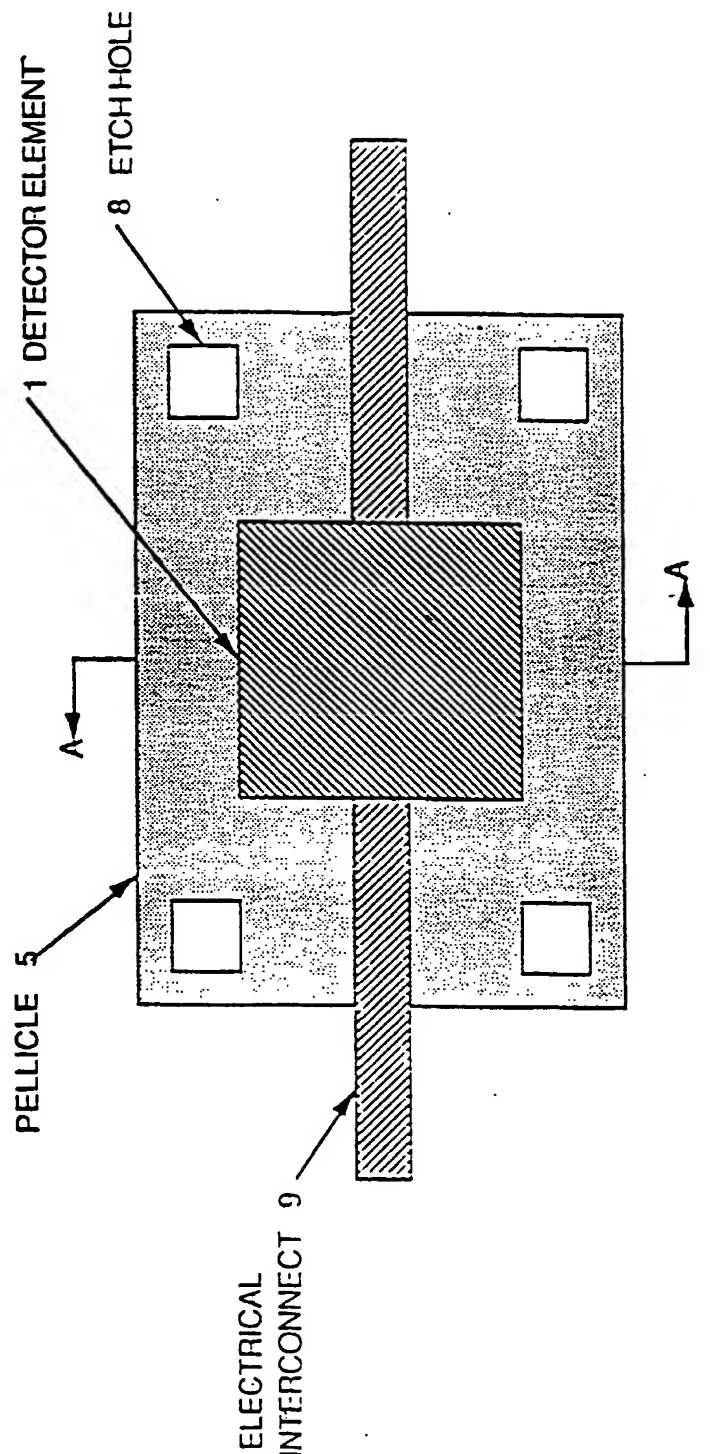

FIGURE 1 SEMICONDUCTOR FILM BOLOMETER - SCHEMATIC PLAN

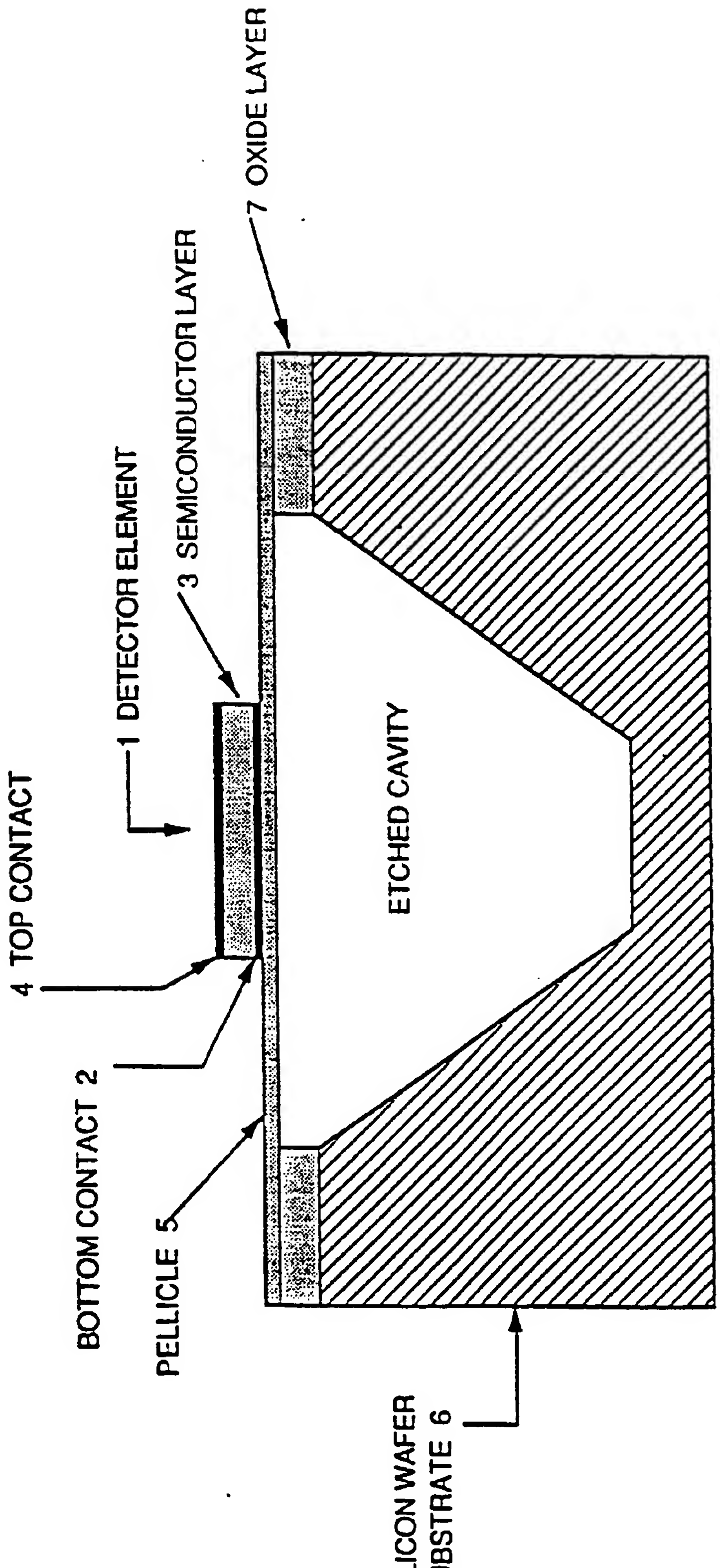

FIGURE 2 SEMICONDUCTOR FILM BOLOMETER - SECTION AA

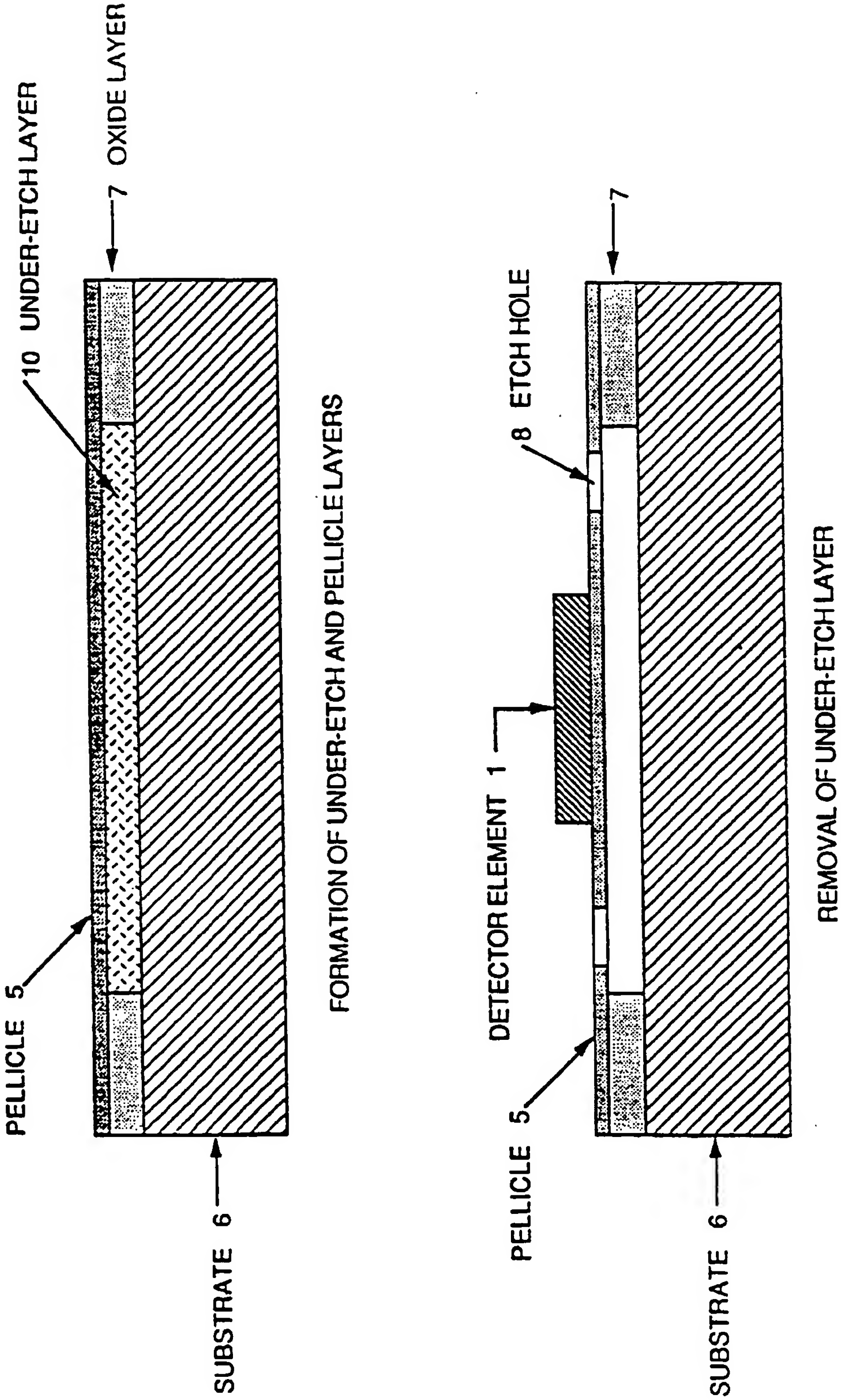

FIGURE 3 METHOD OF THERMAL ISOLATION

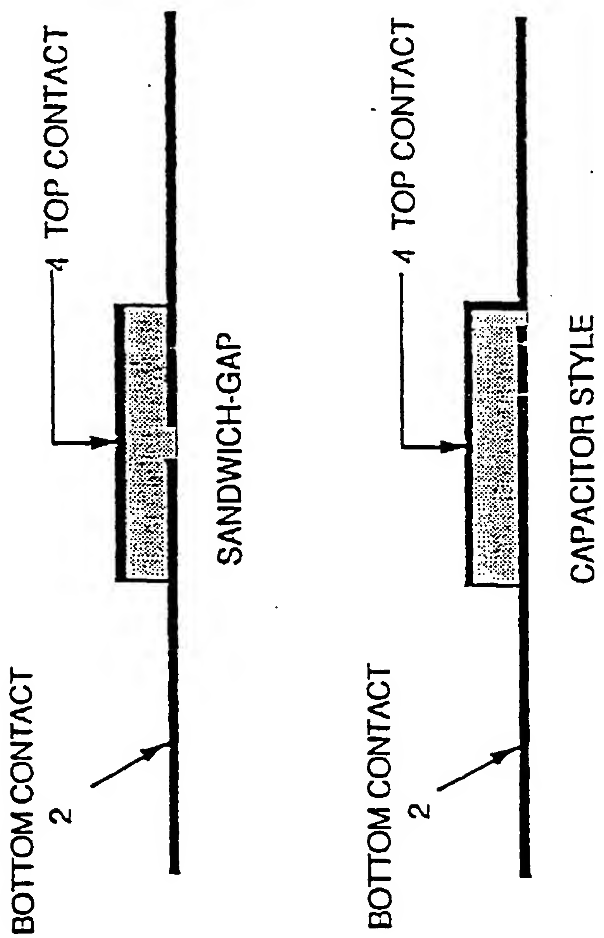

FIGURE 4 CONTACT CONFIGURATIONS

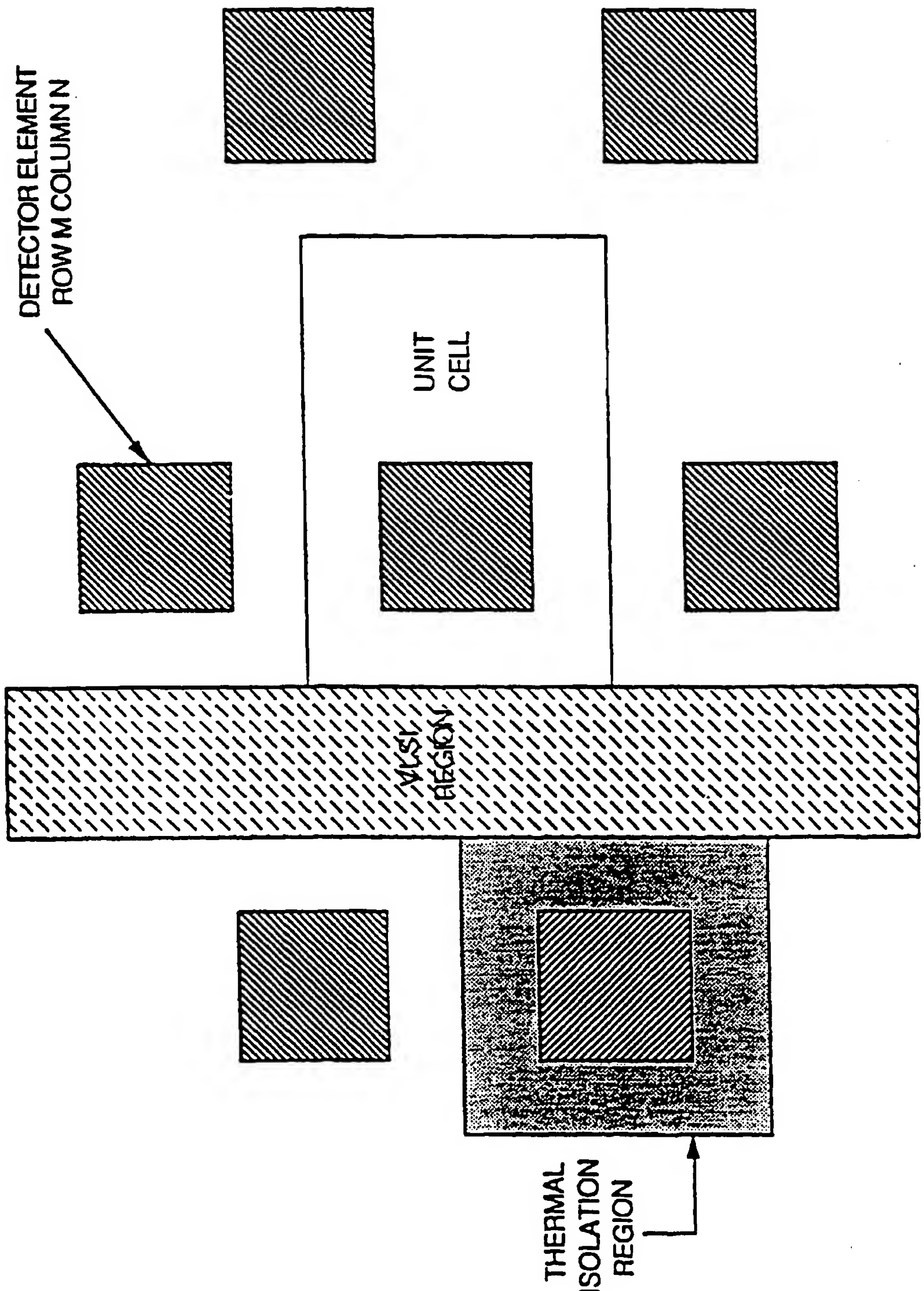

FIGURE 5 DETECTOR ARRAY SCHEMATIC